Geographic Information System (GIS)
INFORMATION SHEET
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What's a Geographic Information System?

A Geographic Information System (GIS) describes any automated system for spatially managing and analyzing geographic information.

In simplest terms, most everything has a physical location on the face of the earth; by default it has a spatial component. GIS is the managing, leveraging, and/or virtual display of information about things that have a spatial component.

Most but not all geographic data has a projection, which is a mathematical attempt to place what is seen on a flat computer screen at the coordinates/location of where it really exists in the three dimensional world.

What kinds of data can GIS use?

Generally speaking, GIS stores two types of spatial data: Vector format data and Raster format data.

Vector data is a coordinate-based data structure commonly used to represent linear map features. Each linear feature is represented as a list of ordered x,y coordinates. Attributes are associated with the feature. Vector data includes:

1. Point features (signs, tractors, grain silos, etc.)
2. Line features (roads, fences, sidewalks, etc.)
3. Polygon features (fields, land use, wetlands, etc.)

Raster data is data displayed as discrete picture elements (pixels). It is a cellular data structure composed of rows and columns. Groups of cells represent features. The value of each cell represents the value of the feature. Raster data can include aerial photography, scanned images, and any other information displayed and stored as pixels.

GIS can also store almost any kind of attribute data. Attribute data is data that further describes spatial data. For example, a point feature may be a sign, but the attribute data could tell us what type of sign it is: stop, yield, or speed limit. Attribute data is stored in associated tables, text files, or databases. The real power of GIS is in accurate attribute data.

For what purpose do people use GIS?

1. Map the location of things: Mapping where things are lets you find places and things you are looking for, and can assist in decision making.

2. Find something: To see where or what an individual feature is, which can help measure distances between it and another related or unrelated feature of interest.

3. Finding patterns: By looking at the distribution of features on the map instead of just an individual feature, patterns can emerge.

4. Map densities: While you can see concentrations by mapping features, in areas with many features it may be difficult to see which areas have a higher concentration than others. A density map allows measurement of the number of features, so you can clearly see the distribution.

5. Map quantities: People map quantities to find places that meet their criteria, or to see the relationships between places, which can aid with decision making. This gives an additional level of information beyond simply mapping the locations of features.

6. Find what's inside something: Monitor what's happening and to take specific action by mapping what's inside a specific area. For example, maybe within a particular city district, crime is higher than in other districts, which could lead Police to increase patrols.

7. Find what's nearby something: Create buffer zones and discover what's occurring within a set distance of a feature.

8. Map changes: Map changes in a particular area in order to predict future conditions, decide on a course of action, or to evaluate the results of a previous decision.

How does the Farm Service Agency (FSA) and Aerial Photography Field Office (APFO) use GIS?

USDA FSA programs help agricultural producers purchase and operate farms, stabilize farm income, conserve land and water, and recover from the effects of disasters.

In order to determine producer benefits for most FSA program areas, FSA must know the specific crop acreage or other land use information. Also, for many programs, producers agree to certain provisions on their land, such as conservation compliance.

GIS helps FSA staff more efficiently measure land features by allowing computer-generated maps to interact with databases that store information about land (attribute data). These advances give local offices tools to:

1. Help producers continue to exercise sensible land stewardship;
2. Provide quicker, more accurate information for decision-making purposes; and
3. Reduce the amount of time a producer must spend working with local FSA staff in order to participate in USDA programs.

USDA-FSA-APFO helps manage 2 primary datasets:

1. Aerial Imagery
2. Common Land Unit (CLU)

Aerial Imagery, a raster dataset, is the base layer in GIS over which other data, such as CLU, a vector dataset, is overlaid and digitized.

Depending on the purpose of the work, other data layers may also be added. The end product is a group of layers that represent real world features in the form of a map. GIS allows for much more detailed information than is contained in a hard copy map with a color-coded legend. Each GIS layer can store and display vast amounts of information, such as soil types, crops, land boundaries, place names, and populations.

No matter how vast the GIS database is, it can be queried and organized to propagate efficient data management practices. A simple GIS query can locate one farm number from thousands, in just seconds.

Further uses of GIS by USDA FSA relate to:

1. Farm Commodity and Conservation Programs
2. Farm Loan Programs
3. Emergency Preparedness
4. Compliance

What is a CLU used for?

The most critical component of GIS for FSA is the development and sustainment of the Common Land Unit (CLU). CLU is the smallest land unit with a permanent contiguous boundary and land cover; in other words, a field. USDA FSA digitizes CLU into Geographic Information System (GIS) shapefiles (soon to be ArcSDE feature classes) and populates associated attribute data.

There are many uses for CLU, including but not limited to:

1. Providing a link between tabular farm records and a map or image of the land;
2. Using GIS for acreage calculations;
3. Replacing paper maps with digital images that can be easily updated and can produce high quality prints whenever necessary;
4. Drawing crop boundaries to better define or use with other data, such as:
    a. Crop Patterns
    b. Subdivisions
    c. Conservation Plans
5. Creating a central database for land unit boundaries and linking it to customers; and
6. Speeding up the process for implementing disaster payment and other specialized systems.

How do farmers benefit from GIS?

GIS technology can help agricultural producers improve production history and farm planning through precision agriculture. Producers can request copies of USDA imagery, farm and field boundaries, and soils data to help them with:

1. Planning, such as determining crop planting strategies
2. Crop production, such as mapping and monitoring fertilizer and herbicide application.

Can I build my own GIS?

Yes. All you need to get started is software and data.

Do I have to purchase GIS software?

No. Much of the software for basic GIS functionality is free for download; while more advanced GIS software does come with an associated cost.

For more information on free GIS software and downloads, go to the following sites:

http://software.geocomm.com/viewers/
http://gislounge.com/ll/freedataviewers.shtml
http://spatialnews.geocomm.com/features/viewers2002/
http://www.apfo.usda.gov/viewers.htm

This list is provided for convenience; USDA-FSA-APFO does not support or endorse these products or services.

Do I have to purchase GIS data?

No. You can almost always find data for free on the web. There are too many data warehouses to count containing more data than you could process in a lifetime. The key is to know what you are looking for. The Geospatial Data Gateway, at http://datagateway.nrcs.usda.gov/ , contains a great deal of imagery and vector data available for public consumption.

Who do I contact for more information?

1. For APFO sales and product information, contact USDA-FSA-APFO at 2222 W 2300 S, Salt Lake City UT, 84119-2020, call 801-975-3505, or visit www.apfo.usda.gov.
2. For further information on GIS, contact GIS Specialist, David Davis, at 801-975-3500 X278, or GIS Specialist, Brian Vanderbilt, at X240.